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(54) Title: HAIR STYLING COMPOSITION (57) Abstract <p>A hair styling composition is provided which is particularly suitable for use in the form of a mousse. The composition comprises up to 10 % by weight of an organic adhesive polymer and up to 5 % by weight of an ethoxylated alcohol having an aliphatic chain length of up to 16 carbon atoms and a degree of ethoxylation of from 3 to 20 ethoxy groups per mole, and a solvent such as water. The composition provides a foam which is stable at rest but which readily breaks down under shear to form a creamy liquid which can easily be worked into the hair.</p>		

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HAIR STYLING COMPOSITION

5

TECHNICAL FIELD

The present invention relates to a hair styling composition which provides flexible and good holding film texture. The invention relates, in particular to a hair styling composition in the form of a mousse.

10

BACKGROUND OF THE INVENTION

The desire to have the hair retain a particular shape is widely held. The most common methodology for accomplishing this is the application of a composition to dampened hair, after shampooing and/or conditioning, or to dry, styled hair.

15 These styling compositions provide temporary setting benefits and they can be removed by water or by shampooing. The materials used in the compositions to provide the setting benefits have generally been resins and have been applied in the form of mousses, gels, lotions or sprays. Furthermore, these styling compositions are formulated for additional purposes such as shampooing, 20 conditioning, treating, dyeing, and combinations thereof.

A major desire by the consumer regarding performance of styling compositions has been the ability to hold the hair. Good hold has often been associated with strong and long styling and/or setting of the hair. However, it was also noticed that styling compositions having holding ability beyond a certain degree can also 25 leave the hair feel rough, difficult to comb out, and can be difficult to remove upon shampooing. Further, in recent years, some consumers have expressed a desire to have hair styling products which can allow re-arrangement of hair without compromise to hair holding ability. As styling compositions with good holding ability commonly provide a rigid film texture, it was difficult to provide a 30 composition with flexible film texture which would allow re-arrangement of hair.

Thus, there is a desire to have hair styling compositions which have a good hold without compromise to ability to re-arrange hair, can provide supple, soft feeling to the hair, and can be removed easily from the hair upon shampooing.

It is also desired to have a hair styling composition in the form of a mousse which provides foams which have improved stability under rest but which undergo rapid collapse to form creamy liquids under shear.

SUMMARY OF THE INVENTION

Thus, the present invention provides a hair styling composition comprising
10 by weight:

- (a) up to about 10% of at least one organic adhesive polymer;
- (b) up to about 5% of at least one surfactant comprising an ethoxylated alcohol having an alkyl chain length of up to about 16 carbon atoms and a degree of ethoxylation of from about 3 to about 20 ethoxy groups per mole; and
- 15 (c) a solvent.

The hair styling composition according to the invention may be in any suitable form for application to the hair such as mousses, gels, lotions or sprays. However, it is preferred for the composition to be in the form of a mousse
20 additionally comprising a propellant.

DETAILED DESCRIPTION

The organic polymer (a) is present in the composition in an amount of up to about 10% by weight preferably up to about 5% by weight, more preferably from about 1 to 3% by weight and most preferably from about 2 to 2.5% by weight. The polymer may be any conventional organic styling polymer suitable for use as a hair fixative including cationic, anionic, amphoteric and neutral polymers. Cationic, anionic and amphoteric polymers are preferred.

The ethoxylated alcohol (b) is present in an amount of up to about 5% by weight, most preferably from about 0.1 to about 1.0% by weight. The ethoxylated alcohol may be used as sole surfactant or in conjunction with a co-surfactant.

According to the present invention it has been found that improved foams
5 are provided by incorporating a small amount of an ethoxylated alcohol in a hair styling composition including a styling polymer. The styling polymer is also incorporated in a small amount relative to conventional hair styling compositions.

It is known that surfactants stabilise the liquid walls or lamellae within foam structures. According to the invention it has been found that the use of
10 ethoxylated alcohols having a specified chain length and a specified degree of ethoxylation leads to enhanced stability of the lamellae. Furthermore, under conditions of shear, the foam collapses rapidly to leave a creamy liquid that can be rapidly applied to the hair for styling. The chain length of the parent alcohol and the degree of ethoxylation can be adjusted within the specified ranges to
15 influence the ability of the surfactant to stabilise the lamellae under differing shear conditions.

The composition according to the invention is described in more detail in the following.

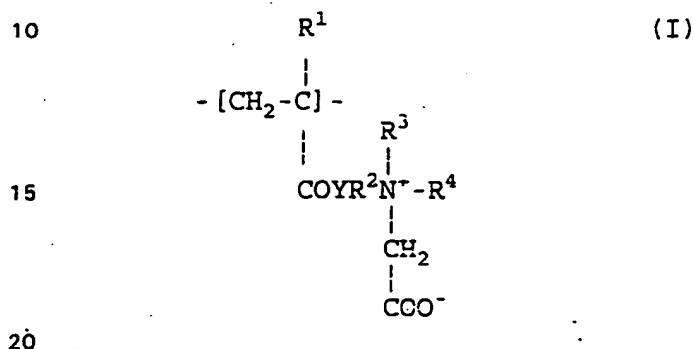
All percentages herein are by weight of the compositions unless otherwise
20 indicated. All ratios are weight ratios unless otherwise indicated. The total of components except for propellant is hereinafter defined as a "concentrate". For non-aerosol products containing no propellant, the concentrate is equal to the entire composition. All percentages, ratios, and levels of ingredients referred to herein are based on the actual amount of the ingredient, and do not include
25 solvents, fillers, or other materials with which the ingredient may be combined as commercially available products, unless otherwise indicated.

Any adhesive polymers suitable for application to the hair can be used as the adhesive polymer in the present invention. These include but are not limited to

homopolymers and copolymers (including block copolymers and random copolymers) and silicone-containing polymers. As used herein, copolymers refers to any polymers containing two or more different types of monomers. Random copolymers are most commonly used.

5 The polymer may be an amphoteric polymer selected for example, from amongst the following polymers (1) to (5).

(1) Polymers of betainised dialkylaminoalkyl (meth)acrylate or dialkylaminoalkyl (meth)acrylamide containing at least units of the formula:

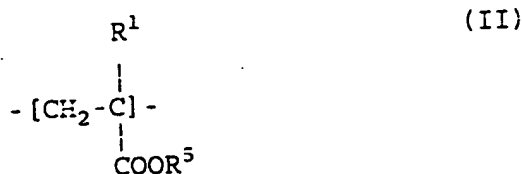


wherein R^1 denotes a hydrogen atom or a methyl group, R^2 denotes an alkylene group having 1 to about 4 carbon atoms, Y denotes O or -NH- and R^3 and R^4 independently of one another denote hydrogen or alkyl having 1 to about 4 carbon atoms, and one cationic derivative consisting of a cationic surfactant containing

25 at least one nitrogen atom joined to one or more fatty chains and optionally quaternised, or consisting of a cationic polymer of the polyamine, polyaminopolyamide or poly-(quaternary ammonium) type, the amine or ammonium groups forming part of the polymer chain or being joined thereto. These polymers usually have a molecular weight of about 500 to about 2,000,000.

30 The amphoteric polymers containing units corresponding to the above formula (I) are generally in the form of copolymers which contain, in addition to the units of the above mentioned formula (I), at least units of the formula

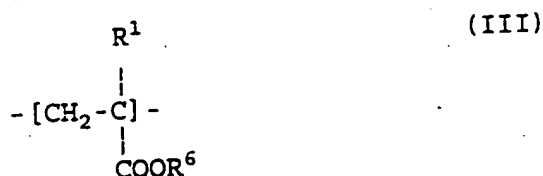
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wherein R^1 is as defined above and R^5 represents an alkyl or alkenyl radical having from about 4 to about 24 carbon atoms or a cycloalkyl radical having from about 4 to about 24 carbon atoms.

10 It is also possible to use terpolymers, tetrapolymers or pentapolymers which contain, in addition to the units (I) and (II) defined above, units of the formula:



15

wherein R^6 preferably denotes an alkyl or alkenyl group having 1 to about 3 carbon atoms and R^1 is as defined above.

20 The units of the formula (I) are preferably present in an amount of 25 to 45% by weight, units of the formula (II) are preferably present in an amount of 5 to 65% by weight, and units of the formula (III) are preferably present in an amount up to 50% by weight, relative to the total weight of the polymer.

A preferred polymer is the copolymer containing units of the formulae (I), (II) and (III) in which Y denotes an oxygen atom, R^2 denotes the group $-\text{C}_2\text{H}_4-$, R^1 , R^3 and R^4 denote methyl, R^5 denotes an alkyl group having about 4 to about 18 carbon atoms and R^6 denotes an alkyl group having 1 to about 3 carbon atoms. The average molecular weight of this polymer is preferably from about 70,000 to about 90,000. This polymer is sold under the trademark "Yukaformer" or

30 "Diaformer" supplied by Mitsubishi Chemical Corporation.

(2) Polymers resulting from the copolymerisation of a vinyl monomer carrying a carboxyl group, such as acrylic acid, methacrylic acid, maleic acid or

alphachloroacrylic acid, and a basic monomer which is a substituted vinyl compound containing at least one basic nitrogen atom, such as dialkylaminoalkyl methacrylates and acrylates and dialkylaminoalkylmethacrylamides and - acrylamides.

5 (3) Polymers containing units derived from

i) at least one monomer chosen from amongst acrylamides or methacrylamides substituted on the nitrogen by an alkyl radical,

ii) at least one acid comonomer containing one or more reactive carboxyl groups, and

10 iii) at least one basic comonomer, such as esters, with primary, secondary and tertiary amine substituents and quarternary ammonium substituents, of acrylic and methacrylic acids, and the product resulting from the quaternisation of dimethylaminoethyl methacrylate with dimethyl or diethyl sulphate.

The N-substituted acrylamides or methacrylamides which are most particularly
15 preferred are the groups in which the alkyl radicals contain from about 2 to about 12 carbon atoms, especially N-ethylacrylamide, N-tert.-butylacrylamide, N-tert.-octylacrylamide, N-octylacrylamide, N-decylacrylamide and N-dodecylacrylamide and also the corresponding methacrylamides. The acid comonomers are chosen more particularly from amongst acrylic, methacrylic, crotonic, itaconic, maleic and
20 fumaric acids and also the alkyl monoesters of maleic acid or fumaric acid in which alkyl has 1 to about 4 carbon atoms.

The preferred basic comonomers are aminoethyl, butylaminoethyl, N,N'-dimethylaminoethyl and N-tert.-butylaminoethyl methacrylates.

(4) Crosslinked and alkylated polyaminoamides partially or totally derived from
25 polyaminoamides of the general formula:



wherein R represents a divalent radical derived from a saturated dicarboxylic acid, from a monocarboxylic or dicarboxylic aliphatic acid with an ethyl nic doubl

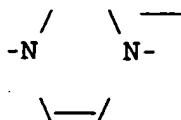
bond, or from an ester of a lower alkanol having 1 to about 6 carbon atoms and of these acids or of a radical derived from the addition of any one of the said acids onto a bis-primary or bis-secondary amine, and Z denotes a radical of a bis-primary or mono- or bis-secondary polyalkylene-polyamine, and preferably
 5 represents:

i) in proportions of about 60 to about 100 mol %, the radical



wherein x is 2 and N is 2 or 3 or alternatively x is 3 and n is 2, this radical being derived from diethylenetriamine, triethylenetetramine or dipropylenetriamine;

10 ii) in proportions of 0 to about 40 mol %, the above radical (II) wherein x is 2 and n is 1 and which is derived from ethylenediamine, or the radical



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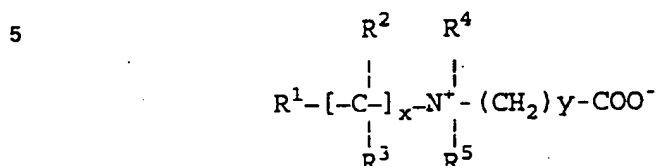
derived from piperazine; and

iii) in proportions of 0 to about 20 mol %, the radical $-\text{NH}-(\text{CH}_2)_6\text{-NH}-$, derived
 20 from hexamethylenediamine, these polyaminoamides being crosslinked by the addition of a difunctional crosslinking agent chosen from amongst epihalogenohydrins, diepoxides, dianhydrides, and bis-unsaturated derivatives, using about 0.025 to about 0.35 mol of crosslinking agent per amine group of the polyaminoamide, and being alkylated by reaction with acrylic acid, chloroacetic
 25 acid or an alkane-sultone or their salts.

The saturated carboxylic acids are preferably chosen from amongst acids having about 6 to about 10 carbon atoms, such as adipic acid, 2,2,4- and 2,4,4-trimethyladipic acids, terephthalic acid and acids with an ethylenic double bond, such as acrylic, methacrylic and itaconic acids.

The alkane-sultones used in the alkylation are preferably propane- or butane-sultone, and the salts of the alkylating agents are preferably the sodium or potassium salts.

(5) Polymers containing zwitterionic units derived from the formula:

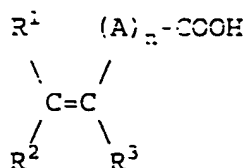


wherein R^1 denotes a polymerisable unsaturated group, such as an acrylate, methacrylate, acrylamide or methacrylamide group, x and y independently represent an integer from 1 to 3, R^2 and R^3 independently represent hydrogen, methyl, ethyl or propyl, and R^4 and R^5 independently represent a hydrogen atom or an alkyl radical such that the sum of the carbon atoms in R^4 and R^5 does not exceed 10.

Highly preferred amphoteric polymers include commercially available material such as octylacrylamine/acrylates/butylaminoethyl methoacrylate copolymers with the tradenames; AMPHOMER, AMPHOMER LV71, and AMPHOMER LV47 supplied by National Starch & Chemical, and methoacryloyl ethylbetaine/acrylates copolymers with the tradenames; YUKAFORMER SM, YUKAFORMER 301, YUKAFORMER 510, YUKAFORMER M-75, and YUKAFORMER R250S supplied by Mitsubishi Chemical Corporation.

Anionic polymers useful in the present invention include polymers containing units derived from a carboxylic, sulphonic or phosphoric acid and usually have a molecular weight of about 500 to about 5,000,000. These polymers are water-soluble polymers, it being possible for this solubility to be obtained by neutralisation.

The carboxylic acid groups can be provided by unsaturated monocarboxylic or dicarboxylic acids, such as those corresponding to the formula:



wherein n is 0 or an integer from 1 to about 10, A denotes a -ethylene group optionally joined to the carbon atom of the saturated group, or to the adjacent methylene group in the case where n is greater than 1, via a heteroatom, such as oxygen or sulphur, R¹ denotes a hydrogen atom or a phenyl or benzyl group, R² denotes a hydrogen atom, a lower alkyl group or a carboxyl group and R³ denotes a hydrogen atom, a lower alkyl group, CH₂COOH, or a phenyl or benzyl group.

Preferred anionic polymers containing carboxylic acid groups are:

(1) Homopolymers or copolymers of acrylic or methacrylic acid or salts thereof, and in particular, the products sold under the name VERSICOL E or K by BASF and under the name DARVAN No. 7 by Van der Bilt; acrylic acid/acrylamide copolymers sold in the form of their sodium salt under the name RETEN 421, 423 or 425 by HERCULES; and the sodium salts of polyhydroxycarboxylic acids, sold under the name HYDAGEN F by HENKEL.

(2) Copolymers of acrylic or methacrylic acid with a monoethylenic monomer, such as ethylene, styrene, a vinyl or allyl ester or acrylic or methacrylic acid ester, optionally grafted onto a polyalkylene glycol, such as polyethylene glycol, and optionally crosslinked. Other such copolymers contain an optionally N-alkylated and/or N-hydroxylated acrylamide unit in their chain, such as those sold under the name QUADRAMER 5 by American Cyanamid.

(3) Copolymers derived from crotonic acid, such as those containing, in their chain, vinyl acetate or propionate units and optionally other monomers such as allyl or methallyl esters, a vinyl ether or a vinyl ester of a saturated linear or branched carboxylic acid with a hydrocarbon chain of at least 3 carbon atoms, if appropriate, for these polymers to be grafted and crosslinked, or also a vinyl, allyl

or methallyl ester of an - or -cyclic carboxylic acid. Included in this class are those with the tradename RESYN 28-2930, 28-2913, and 28-1310 sold by National Starch & Chemicals.

(4) Polymers derived from maleic, fumaric and itaconic acids or anhydrides
5 with vinyl esters, vinyl ethers, vinyl halides, phenylvinyl derivatives, acrylic acid and its esters, such as those sold under the name GANTREZ A, SP, and ES by ISP. Other polymers included in this class are copolymers of maleic, citraconic and itaconic anhydrides with an allyl or methallyl ester optionally containing an acrylamido or methacrylamido group, or with an -olefine, acrylic or methacrylic
10 acid ester, acrylic or methacrylic acid or vinylpyrrolidone unit in their chain; the anhydride groups can be monoesterified or monoamidified.

(5) Polyacrylamides containing carboxylate groups. Polymers comprising sulphonic groups include polymers containing vinylsulphonic, styrenesulphonic, lignosulphonic or naphthalenesulphonic units. These polymers are chosen, in
15 particular, from amongst:

i) Polyvinylsulphonic acid salts having a molecular weight of about 1,000 to about 100,000, and also copolymers with an unsaturated comonomer, such as acrylic or methacrylic acid or an ester thereof and also substituted or unsubstituted acrylamide or methacrylamide, vinyl esters, vinyl ethers and
20 vinylpyrrolidone.

ii) Polystyrenesulphonic acid salts, such as the sodium salt sold by National Starch & Chemicals under the name Flexan 500 and 130.

iii) Alkali metal or alkaline earth metal salts of sulphonic acids derived from lignin, and more particularly calcium lignosulphonates or sodium lignosulphonates,
25 such as the product sold under the name Marasperse C-21 by American Can Co. and the C₁₀ to C₁₄ products sold by Avebene.

iv) Polymers containing salified alkyl naphthalenesulphonic acid units, such as the sodium salt under the name Darvan No. 1 by Van der Bilt.

The anionic polymers herein which include anionic monomers are preferably utilised in at least partially neutralised form in order to aid shampoo removability of the liquid hair cosmetic compositions. In the compositions according to the present invention the neutralisation of a polymer may be achieved by use of an inorganic base, preferably KOH. However organic base, preferably AMP (amino methyl propanol) and mixture of inorganic and organic base may also be used to effect the desired level of neutralisation in hair styling compositions according to the present invention. In total from about 50% to about 100%, preferably from about 70% to about 100%, most preferably from about 80% to about 100% of the acidic monomers of each polymer utilised should be neutralised with base.

Any conventionally used base, organic or inorganic, may be used for neutralisation of acidic polymers provided they are utilised as specified herein. Hydroxides of alkali, alkaline earth and amino alcohols are suitable neutralisers for use in the present invention.

Examples of suitable organic neutralizing agents which may be included in the compositions of the present invention include amines, especially amino alcohols such as 2-amino-2-methyl-1, 3-propanediol (AMPD), 2-amino-2ethyl-1, 3-propanediol(AEPD), 2-amino-2-methyl-1-propanol(AMP), 2-amino-1-butanol(AB), monethanolamine (MEA), diethanolamine (DEA), triethanolamine (TEA), monoisopropanolamine (MIPA), diisopropanolamine (DIPA), triisopropanolamine (TIPA), dimethylsteramine (DMS) and amino methyl propanol (AMP) and mixtures thereof.

Preferred neutralising agents for use in hair styling compositions of the present invention are potassium and sodium hydroxides.

Highly preferred anionic polymers include commercially available material such as vinyl acetate/crotonic acid/vinyl neodecanoate copolymers and vinyl acetate/crotonic acid copolymers with the tradenames RESYN 28-2930, RESYN 28-2913, and RESYN 28-1310 supplied by National Starch & Chemicals, and

acrylates copolymers and acrylates/acrylamide copolymers with tradenames LUVIMER 100P, ULTRAHOLD 8, and ULTRAHOLD STRONG supplied by BASF Corporation.

Cationic polymers useful in the present invention include:

5 (1) Vinylpyrrolidone / quaternized dialkylaminoalkyl acrylate or methacrylate copolymers such as those sold under the tradename Gafquat 734 and 755N by the Gaf Corp.

(2) Cellulose ether derivatives containing quaternary ammonium groups.

(3) Cationic polysaccharides.

10 (4) Cationic polymers chosen from the group comprising:

i) polymers containing units of the formula:



wherein A denotes a radical containing two amino groups, preferably a piperazinyl radical, and Z^1 and Z^2 independently denote a divalent radical which is a straight-
 15 chain or branched-chain alkylene radical which contains up to about 7 carbon atoms in the main chain, is unsubstituted or substituted by one or more hydroxyl groups and can also contain one or more oxygen, nitrogen and sulphur atoms and 1 to 3 aromatic and/or heterocyclic rings, the oxygen, nitrogen and sulphur atoms generally being present in the form of an ether or thioether, sulfoxide, sulphone,
 20 sulphonium, amine, alkylamine, alkenylamine, benzylamine, amine oxide, quaternary ammonium, amide, imide, alcohol, ester and/or urethane group;

ii) polymers containing units of the formula:



wherein A denotes a radical containing two amino groups, preferably a piperazinyl
 25 radical, and Z^3 and Z^4 while denoting the symbol Z^4 at least once; Z^3 denotes a divalent radical which is a straight-chain or branched-chain alkyl n or hydroxyalkylene radical having up to about 7 carbon atoms in the main chain, and Z^4 is a divalent radical which is a straight-chain or branched-

chain alkylene radical which has up to about 7 carbon atoms in the main chain, is unsubstituted and substituted by one or more hydroxyl radicals and is interrupted by one or more nitrogen atoms, the nitrogen atom being substituted by an alkyl chain having from 1 to about 4 carbon atoms, preferably 4 carbon atoms, which is optionally interrupted by an oxygen atom and optionally contains one or more hydroxyl groups; and

iii) the alkylation products, with alkyl and benzyl halides of 1 to 6 carbon atoms, alkyl tosylates or mesylates, and the oxidation products, of the polymers of the formulae (I) and (II) indicated above under i) and ii).

10 (5) Polyamino-polyamides prepared by the polycondensation of an acid compound with a polyamine. The acid compound can be organic dicarboxylic acids, aliphatic monocarboxylic and dicarboxylic acids containing a double bond, esters of the abovementioned acids, preferably the esters with lower alkanols having from 1 to 6 carbon atoms, and mixtures thereof. The polyamine is a bis-
15 primary or mono- or bis-secondary polyalkylene-polyamine wherein up to 40 mol% of this polyamine can be a bis-primary amine, preferably ethylenediamine, or a bis-secondary amine, preferably piperazine, and up to 20 mol% can be hexamethylenediamine.

(6) The above mentioned polyamino-polyamides can be alkylated and/or
20 crosslinked. The alkylation can be carried out with glycidol, ethylene oxide, propylene oxide or acrylamide. The crosslinking is carried out by means of a crosslinking agent such as:

i) epihalogenohydrins, diepoxides, dianhydrides, unsaturated anhydrides and bis-saturated derivatives, in proportions of about 0.025 to about 0.35 mol of
25 crosslinking agent per amine group of the polyamino-polyamide;

ii) bis-halogenohydrins, bis-azetidinium compounds, bishalogeno acyldiamines and bis-(alkyl halides);

iii) oligomers obtained by reacting a compound chosen from the group comprising bis-halogenohydrins, bis-azetidinium compounds, bis-halogenoacyl-diamines, bis-(alkyl halides), epihalogenohydrins, diepoxides and bis-unsaturated derivatives, with another compound which is a difunctional compound which is
 5 reactive towards the compound; and

iv) the quaternisation product of a compound chosen from compounds ii) and the oligomers iii) and containing one or more tertiary amine groups which can be totally or partially alkylated with an alkylating agent preferably chosen from methyl or ethyl chlorides, bromides, iodides, sulphates, mesylates and tosylates,
 10 benzyl chloride or bromide, ethylene oxide, propylene oxide and glycidol, the crosslinking being carried out by means of about 0.025 to about 0.35 mol, in particular of about 0.025 to about 0.2 mol and more particularly of about 0.025 to about 0.1 mol, of crosslinking agent per amine group of the polyamino-polyamide.

(7) Polyamino-polyamide derivatives resulting from the condensation of a
 15 polyalkylene-polyamine with a polycarboxylic acid, followed by alkylation by means of difunctional agents, such as the adipic acid/dialkylaminohydroxyalkyl-dialkylenetriamine copolymers in which the alkyl radical contains 1 to 4 carbon atoms and preferably denotes methyl, ethyl or propyl.

Useful polymers are adipic acid/dimethylaminohydroxypropyl-diethylenetriamine copolymers sold under the name Cartaretine F, F⁴ or F⁸ by
 20 SANDOZ.

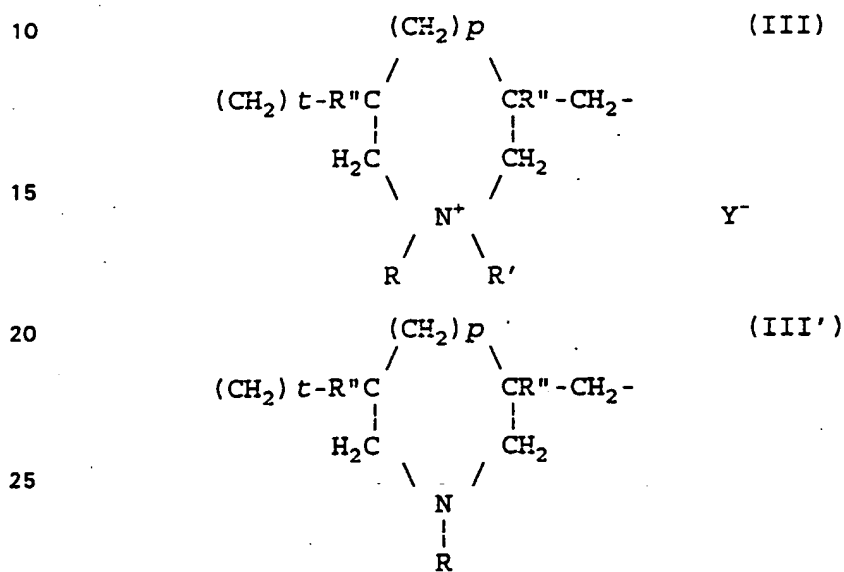
(8) Polymers obtained by reacting polyalkylenepolyamine containing two primary amine groups and at least one secondary amine group, with a dicarboxylic acid chosen from diglycolic acid and saturated aliphatic dicarboxylic
 25 acids having about 3 to about 8 carbon atoms, the molar ratio of the polyalkylene-polyamine to the dicarboxylic acid being from about 0.8:1 to about 1.4:1, and the resulting polyamid being reacted with epichlorohydrin in a molar ratio of

15

epichlorohydrin to the secondary amine groups of the polyamide of from about 0.5:1 to about 1.8:1.

Useful polymers are those sold under the name HERCOSETT 57 by Hercules Incorporated, and that sold under the name PD 170 or DELSETTE 101 by
5 Hercules.

(9) Cyclic polymers generally having a molecular weight of about 20,000 to about 3,000,000 such as homopolymers containing, as the main constituent of the chain, units corresponding to the formula (III) or (III')

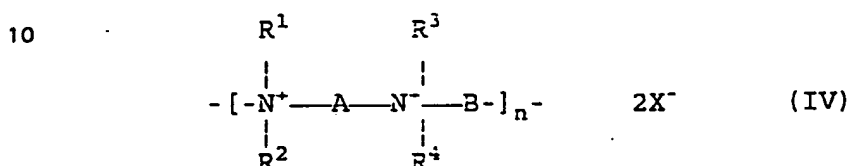


30 in which p and t are 0 or 1, and $p+t=1$, R'' denotes hydrogen or methyl, R and R' independently of one another denote an alkyl group having from 1 to about 22 carbon-atoms, a hydroxylalkyl group in which the alkyl group preferably has 1 to about 5 carbon atoms, or a lower amidoalkyl group, and R and R' can denote, together with the nitrogen atom to which they are attached, heterocyclic groups
35 such as piperidiny1 or morpholinyl, and Y is bromide, chloride, acetate, borate, citrat, tartrate, bisulphate, bisulphite, sulphat or phosphate. Copolymers

containing units of the formula III and III' may also contain units derived from acrylamide or from diacetoneacrylamide.

Amongst the quaternary ammonium polymers of the type defined above, those which are preferred are the dimethyldiallylammonium chloride homopolymer sold under the name MERQUAT 100 and having a molecular weight of less than about 100,000, and the dimethyldiallylammonium chloride/acrylamide copolymer having a molecular weight of more than about 500,000 and sold under the name MERQUAT 550 by CALGON Corporation.

(10) Poly-(quaternary ammonium) compounds of the formula

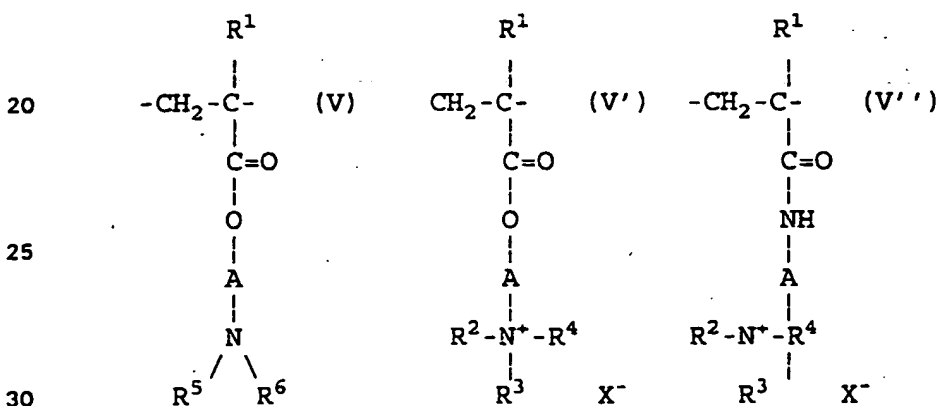


wherein R^1 , R^2 , R^3 , and R^4 are independently aliphatic, alicyclic or arylaliphatic radicals containing a maximum of about 20 carbon atoms, or lower hydroxyaliphatic radicals, or alternatively, with the nitrogen atoms to which they are attached, heterocyclic rings optionally containing a second hetero-atom other than nitrogen, or alternatively R^1 , R^2 , R^3 , and R^4 represent a group $\text{CH}_2\text{CHR}^3\text{R}^4$ wherein R^3 denoting hydrogen or lower alkyl and R^4 denoting SO , CN , $\text{CON}(\text{R}^6)_2$, COOR^5 , COR^5 , COOR^7D , or CONHR^7D ; R^5 denoting lower alkyl, R^6 denoting hydrogen or lower alkyl, R^7 denoting alkylene and D denoting a quaternary ammonium group; A and B independently represent a polymethylene group containing from about 2 to about 20 carbon atoms, which can be linear or branched, saturated or unsaturated and can contain, inserted in the main chain one or more groups $-\text{CH}_2-\text{Y}-\text{CH}_2-$ wherein Y denotes benzene, oxygen, sulfur, SO , SO_2 , SS , NR^8 , $\text{N}^+(\text{R}^9)_2\text{X}^{1-}$, CHOH , NHCONH , CONR^8 , or COO ; X^{1-} denoting an anion derived from a mineral or organic acid, R^8 denoting hydrogen or lower alkyl and R^9 denoting lower alkyl, or alternatively A and R^1 and R^3 form

a piperazine ring with the two nitrogen atoms to which they are attached. If A denotes a linear or branched, saturated or unsaturated alkylene or hydroxyalkylene radical, B can also denote a group: $-(CH_2)_n-CO-D-OC-(CH_2)_n-$; wherein n is selected so that the molecular weight is generally between 1,000 and 100,000; and D denotes:

- i) a glycol radical of the formula $-O-Z-O-$, in which Z denotes a linear or branched hydrocarbon radical or a group corresponding to the formulae:
 $-[CH_2-CH_2-O]_x-CH_2-CH_2-$ or $-[CH_2-C(CH_3)H-O]_y-CH_2-C(CH_3)H-$ wherein x and y denote an integer from 1 to about 4, representing a definite and unique degree of polymerisation;
- ii) a bis-secondary diamine radical, such as a piperazine derivative;
- iii) a bis-primary diamine radical of the formula: $-N-H-Y-NH-$, in which Y denotes a linear or branched hydrocarbon radical or the divalent radical $-CH_2-CH_2-S-S-CH_2-CH_2-$; or
- iv) a ureylene group of the formula $-N-H-CO-NH-$.

(11) Homopolymers or copolymers derived from acrylic or methacrylic acid and containing at least one unit:



wherein R^1 is H or CH_3 , A is a linear or branched alkyl group having 1 to 6 carbon atoms or a hydroxyalkyl group having 1 to about 4 carbon atoms, R^2 , R^3

and R^4 independently denote an alkyl group having 1 to about 18 carbon atoms or a benzyl group, R^5 and R^6 denote H or alkyl having 1 to about 6 carbon atoms and X denotes methosulphate or halide, such as chloride or bromide.

The comonomer or comonomers which can be used typically belong to the family comprising: acrylamide, methacrylamide, diacetone-acrylamide, acrylamide and methacrylamide substituted on the nitrogen by one or more lower alkyls, alkyl esters of acrylic and methacrylic acids, vinylpyrrolidone and vinyl esters.

Useful polymers are Quaternium 38, 37, 49 and 42 in the CTFA, acrylamide/beta-methacryloyloxyethyl-trime-thylammonium methosulphate copolymers sold under the names Teten 205,210,220 and 240 by Hercules, and aminoethylacrylate phosphate/acrylate copolymer sold under the name Catrex by National Starch & Chemicals, and the crosslinked graft cationic copolymers having a molecular weight of about 10,000 to about 1,000,000, and preferably of about 15,000 to about 500,000, and resulting from the copolymerisation of: at least one cosmetic monomer, dimethylaminoethyl methacrylate, polyethylene glycol and a polyunsaturated crosslinking agent, such as those mentioned in the CTFA dictionary under the name AMODIMETHICONE, such as the product marketed as a mixture with other ingredients under the name DOW CORNING 929 cationic emulsion.

(12) Other cationic polymers which can be used are polyalkyleneimines, in particular polyethyleneimines, polymers containing vinylpyridine units or vinylpyridinium units in the chain, condensates of polyamines and of epichlorohydrin, poly-(quaternary ureylenes) and chitin derivatives.

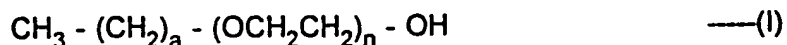
Silicone-containing adhesive polymers that can be used include any polymers containing one or more silicone portions and one or more adhesive carbon, chain-based portions, where upon drying of the solvent the product typically separates into a continuous phase and a discontinuous phase, wherein one of said phases

be any carbon, or other carbohydrate material, and provide the adhesive properties of the polymer. Preferably the silicone forms a discontinuous phase upon drying and the carbon or carbohydrate portion forms the continuous phase. Alternately, the silicone-containing polymers can be in the form of block copolymers wherein both portions form discontinuous phases. Preferred silicone-containing polymers are silicone grafted vinyl-backbone polymers such as those disclosed in EP 0 412 704, incorporated herein by reference, especially silicone grafted polymers comprising acrylic acid/t-butyl acrylate backbones.

Other adhesive polymers that can be used include, without limitation, thermoplastic elastomeric polymers, such as those disclosed in PCT/US/07387 (WO 95/01384), incorporated herein by reference.

Highly preferred cationic polymers include commercially available material such as Polyquaternium 4 under the tradenames CELQUAT H100 and CELQUAT L200 supplied by National Starch & Chemicals, and Polyquaternium 11 under the tradename GAFQUAT 755N supplied by ISP.

The surfactant component (b) of the composition according to the invention essentially comprises an ethoxylated alcohol having an aliphatic, preferably alkyl chain length of up to about 22 carbon atoms and a degree of ethoxylation of from about 3 to about 30 ethoxy groups per mole, corresponding to the following structure:



where a has an average value of 1 to about 22, preferably and n has an average value of 3 to 30.

The aliphatic preferably alkyl chain length of the ethoxylated alcohol is preferably up to 16 carbon atoms, more preferably up to 14 carbon atoms and, most preferably up to 12 carbon atoms. A C₉₋₁₁ ethoxylated alcohol is most preferred.

The degree of ethoxylation of the ethoxylated alcohol is preferably about 4 to 20, more preferably about 5 to 16, most preferably about 6 to 12 and with particular preference about 7 to 9 ethoxy groups per mole.

The ratio of alcohol aliphatic chain length to degree of ethoxylation of the ethoxylated alcohol is preferably from about 7:4 to 4:7, more preferably from about 6:4 to 5:6, with particular preference from about 6:4 to 1:1 and most preferably about 5:4.

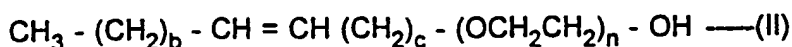
Examples include, C₉₋₁₁ Pareth 8; C₁₁₋₁₃ Pareth 8; and C₁₁₋₁₃ Pareth 9.

A particularly preferred ethoxylated alcohol is C₉₋₁₁ Pareth 8.

The ethoxylated alcohol may be used alone or in conjunction with a co-surfactant. Examples of suitable co-surfactants include other nonionic surfactants which provide softness to the foam, when the composition is in the form of a mousse, such as polyoxyethylene, a polyoxy propylene, and mixtures thereof.

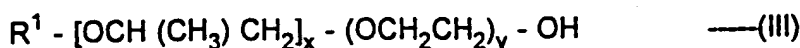
Non-limiting examples of additional nonionic surfactants for use in the styling composition of the present invention are as follows:

(1) Polyoxyethylene alkenyl ether having the following general structure;



wherein b has an average value from 1 to 10, c has an average value from about 1 to about 10, n has an average value from about 2 to about 200;

(2) Polyoxypropylene polyoxyethylene alkyl or alkenyl or iso-alkyl or iso-alkenyl or dimethylpolysiloxane ether having the following general structure;



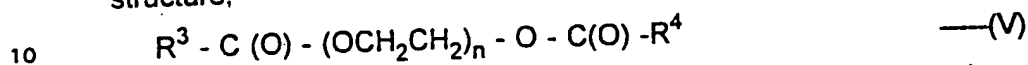
wherein R¹ is selected from the group consisting of alkyl, alkenyl, iso-alkyl, alkenyl, and dimethylpolysiloxane derivatives, x has an average value from about 2 to about 100; and y has an average value from about 2 to about 100;

(3) Polyoxyethylene long chain alkyl fatty acid or benzen derivative ether having the following general structure;



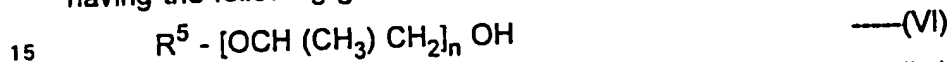
wherein R^2 is selected from the group consisting of castor oil triglyceride castorate, cholesterol, coconut oil triglyceride cocoate, alkyl phenol, glyceryl laurate, glyceryl oleate, glyceryl cocoate, glyceryl isostearate, glyceryl stearate, 5 hydrogenated castor oil triglyceride hydrogenated castorate, hydrogenated lanolin, nonyl phenyl and dimethylpolysiloxane derivatives, and n has an average value from about 2 to about 200;

(4) Polyoxyethylene alkyl, or alkenyl ether having the following general structure;



wherein R^3 and R^4 are independently selected from the group consisting of alkyl, iso-alkyl, and alkenyl, and n has an average value from about 2 to about 200;

(5) Polyoxypropylene alkyl, iso-alkenyl or long chain alkyl fatty acid ether having the following general structure;



wherein R^5 is selected from the group consisting of alkyl, iso-alkyl and alkenyl, and n has an average value of about 2 to about 200.

Solvents used in the present invention are selected depending on variables such as the remainder of components, viscosity, and desired foaming 20 characteristic of the composition.

Non-limiting examples of solvents useful in the present invention are: water, lower alcohols having 1 to about 6 carbons such as ethanol and isopropanol, and polyhydric alcohols such as propylene glycol, hexylene glycol, glycerin, and propane diol, and mixtures thereof. For mousse compositions, the solvent 25 comprises at least about 80% water, more preferably at least about 90% water.

The solvent is preferably comprised at a level by weight of from about 60% to about 99%, more preferably from about 80 to about 99%, most preferably from about 85% to about 98% of the concentrate.

OPTIONAL COMPONENTS

Optional components can be included in the hair styling compositions of the present invention, depending on the needs of the product. Non-limiting examples of such optional components include conditioning agents, preservatives, perfume, ultraviolet and infrared screening and absorbing agents, colorants, pH adjusters, dyes, vitamins, proteins, plant extracts, and nutrients.

Conditioning agents

Conditioning agents may be comprised in the hair styling composition of the present invention. Suitable conditioning agents include fatty alcohols, fatty acids, hydrocarbons and silicones including volatile and non-volatile silicone fluids preferably of low molecular weight.

The fatty alcohols useful herein are those having from about 10 to about 30 carbon atoms, preferably from about 12 to about 22 carbon atoms, and more preferably from about 16 to about 22 carbon atoms. These fatty alcohols can be straight or branched chain alcohols and can be saturated or unsaturated. Nonlimiting examples of fatty alcohols include decyl alcohol, undecyl alcohol, dodecyl, myristyl, cetyl alcohol, stearyl alcohol, isostearyl alcohol, isocetyl alcohol, behenyl alcohol, linalool, oleyl alcohol, cholesterol, *cis-4-t*-butylcyclohexanol, myricyl alcohol and mixtures thereof. Especially preferred fatty alcohols are those selected from the group consisting of cetyl alcohol, stearyl alcohol, isostearyl alcohol, oleyl alcohol, and mixtures thereof. The fatty acids useful herein are those having from about 10 to about 30 carbon atoms, preferably from about 12 to about 22 carbon atoms, and more preferably from about 16 to about 22 carbon atoms. These fatty acids can be straight or branched chain acids and can be saturated or unsaturated. Also included are diacids, triacids, and other multiple acids which meet the carbon number requirement herein. Also included herein are salts of these fatty acids. Nonlimiting examples of fatty acids include lauric acid, palmitic acid, stearic acid, behenic acid, arachidonic acid, oleic acid,

isostearic acid, sebacic acid, and mixtures thereof. Especially preferred for use herein are the fatty acids selected from the group consisting of palmitic acid, stearic acid, and mixtures thereof.

Hydrocarbons are useful herein as conditioning agents. Useful hydrocarbons
5 include straight chain, cyclic, and branched chain hydrocarbons which can be either saturated or unsaturated. The hydrocarbons preferably will have from about 12 to about 40 carbon atoms, more preferably from about 12 to about 30 carbon atoms, and most preferably from about 12 to about 22 carbon atoms. Also encompassed herein are polymeric hydrocarbons of alkenyl monomers, such
10 as polymers of C2-C6 alkenyl monomers. These polymers can be straight or branched chain polymers. The straight chain polymers will typically be relatively short in length, having a total number of carbon atoms as described above in this paragraph. The branched chain polymers can have substantially higher chain lengths. The number average molecular weight of such materials can vary widely,
15 but will typically be up to about 500, preferably from about 200 to about 400, and more preferably from about 300 to about 350. Also useful herein are the various grades of mineral oils. Mineral oils are liquid mixtures of hydrocarbons that are obtained from petroleum. Specific examples of suitable hydrocarbon materials include paraffin oil, mineral oil, dodecane, isododecane, hexadecane,
20 isohexadecane, eicosene, isoeicosene, tridecane, tetradecane, polybutene, polyisobutene, and mixtures thereof. Isododecane, isohexadecane, and isoeicosene are commercially available as Permethyl 99A, Permethyl 101A, and Permethyl 1082, from Presperse, South Plainfield, NJ. A copolymer of isobutene and normal butene is commercially available as Indopol H-100 from Amoco
25 Chemicals. Preferred for use herein are hydrocarbon conditioning agents selected from the group consisting of mineral oil, isododecane, isohexadecane, polybutene, polyisobutene, and mixtures thereof. When included, these

conditioning agents are comprised at a level by weight of from about 0.01% to about 2% of the concentrate.

Preservative

Hair styling compositions of the present invention can further comprise a
5 preservative. Such preservative is preferably included at a level by weight of up to about 5%, more preferably up to about 3% of the concentrate.

Non-limiting examples of preservatives useful in the present invention are DMDM Hydantoin (dimethylol dimethyl hydantoin), Kathon CG, (mixture of methylchloro-isothiazolinone and methyl isothiazolinone), imidazolidinyl urea,
10 phenoxyethanol, EDTA and its salts, benzyl alcohol, and parabens such as methyl paraben, propyl paraben, butyl paraben, and LiquaPar oil (mixture of isobutyl paraben, isopropyl paraben, and butyl paraben).

Other Optional Components

Hair styling compositions of the present invention may further comprise a
15 variety of optional components. Such optional components include; thickeners and viscosity modifiers such as diethanolamides of long chain fatty acids, sodium chloride, and sodium sulfate, ultraviolet absorbing agents such as octyl salicylate, pH adjusting agents such as citric acid, succinic acid, sodium hydroxide and triethanolamine, coloring agents, hair oxidizing agents such as hydrogen peroxide,
20 perborate salts and persulfate salts, hair reducing agents such as thioglycolates, perfumes, perfume solubilizing agents such as polyethylene glycol fatty acid esters, sequestering agents, polymer plasticizing agents such as glycerin and propylene glycol. Such optional ingredients are typically included at a level by weight of up to about 20%, preferably up to about 10% of the concentrate.

25 Hair Styling Compositions

The present invention encompasses a wide variety of hair styling compositions, including hair spray compositions, mousses, and hair setting tonics. In general, the compositions will be flowable, low viscosity compositions that,

preferably, are suitable for spray application. Higher viscosity compositions are also contemplated, however.

Hair spray compositions and mousses of the present invention can be dispensed from containers which are aerosol dispensers or pump spray dispensers. Such dispensers, i.e., containers, are well known to those skilled in the art and are commercially available from a variety of manufacturers, including American National Can Corp. and Continental Can Corp.

When the hair spray compositions are to be dispensed from a pressurized aerosol container, a propellant which consists of one or more of the conventionally-known aerosol propellants may be used to propel the compositions. A suitable propellant for use can be generally any liquifiable gas conventionally used for aerosol containers.

Suitable propellants for use are volatile hydrocarbon propellants which can include liquified lower hydrocarbons of 3 to 4 carbon atoms such as propane, butane and isobutane. Other suitable propellants are hydrofluorocarbons such as 1,2-difluoroethane (Hydrofluorocarbon 152A) supplied as Dymel 152A by DuPont. Other examples of propellants are dimethylether, nitrogen, carbon dioxide, nitrous oxide and atmospheric gas.

The hydrocarbons, particularly isobutane, used singly or admixed with other hydrocarbons are preferred.

The aerosol propellant may be mixed with the present compositions and the amount of propellant to be mixed is governed by normal factors well known in the aerosol art. Generally, for liquifiable propellants, the level of propellant is from about 10% to about 60% by weight of the total composition, preferably from about 15% to about 50% by weight of the total composition.

Alternatively, pressurized aerosol dispensers can be used where the propellant is separated from contact with the hair spray composition such as a two

compartment can of the type sold under the tradename SEPRO from American National Can Corp.

Other suitable aerosol dispensers are those characterized by the propellant being compressed air which can be filled into the dispenser by means of a pump or equivalent device prior to use. Such dispensers are described in U.S. Patents 5 4,077,441, and 4,850,577, and in U.S. Serial No. 07/839,648, Gosselin et al., filed February 21, 1992. Compressed air aerosol containers suitable for use are also currently marketed by The Procter & Gamble Company under their tradename VIDAL SASSOON AIRSPRAY® hair sprays.

10 Conventional non-aerosol pump spray dispensers, i.e., atomizers, can also be used.

Other hair styling compositions include tonics and lotions, which are typically dispensed in a conventional bottle or tube, and applied directly to the hair or first dispensed to the hand and then to the hair.

15 Method of Making

The hair styling compositions of the present invention can be made using conventional formulation and mixing techniques. Preferably, a premix of the polymer and the solvent, is made first. The other ingredients can then be added with mixing to provide a homogeneous mixture.

20 Method of Use

The compositions of the present invention are used in conventional ways to provide the hair styling/holding benefits of the present invention. Such methods generally involve application of an effective amount of the product to dry, slightly damp, or wet hair before and/or after the hair is arranged to a desired style. The 25 composition is then dried or allowed to dry. By "effective amount" is meant an amount sufficient to provide the hair hold and style benefits desired considering the length and texture of the hair. In general, from about 0.5g to about 30g of

product will be applied to the hair, depending upon the particular product formulation, dispenser type, length of hair, and type of hair style.

The present invention is further illustrated by reference to the following Examples. The hair styling compositions are formulated as mousses by
5 conventional techniques known in the art.

All the examples provided foams which were stable under rest for a long period of time but which, when subjected to shear, underwent rapid collapse to form creamy liquids which could easily and efficiently be worked into the hair.

Ingredient	Example 1 wt %	Example 2 wt %	Example 3 wt %	Example 4 wt %	Example 5 wt %	Example 6 wt %	Example 7 wt %
Deionised water	96.6747	96.4247	96.1747	96.6747	96.4247	96.1747	95.9247
Polyquaternium-4	2.0000	2.2500	2.5000	2.0000	2.0000	2.0000	2.0000
DOBANOL 91-8 ⁽¹⁾	0.2500	0.2500	0.2500	0.2500	0.5000	0.7500	1.0000
Propylene Glycol	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000
DMDM Hydantoin ⁽²⁾	0.2140	0.2140	0.2140	0.2140	0.2140	0.2140	0.2140
Fragrance Takasago 6397 ⁽³⁾	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500	0.1500
Disodium EDTA	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
Octyl Salicylate	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
Pantyl B	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
Keratin Amino Acids	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
Citric Acid	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000

- (1) DOBANOL 91-8:- C9-11 Pareth 8 supplied by Shell
 (2) DMDM Hydantoin:- dimethylol dimethyl hydantoin
 (3) Fragrance Takasago 6397:- perfume supplied by Takasago

The Examples showed that the relative proportions of the polymer and the ethoxylated alcohol can be adjusted to provide optimum foam properties.

Specifically, the foams resulting from the compositions of the Examples showed that increasing the polymer level from 2.0% (Example 1) to 2.25% (Example 2) and 2.5% (Example 3) while maintaining the same level of ethoxylated alcohol provides a higher viscosity build and poorer actuation rate. Further, increasing the level of ethoxylated alcohol from 0.25% (Example 4) to 0.5% (Example 5) 0.75% (Example 6) and 1.0% (Example 7) while maintaining the same level of polymer results in increased foam "rubberiness" and stiffness and the foam became harder to break under shear.

CLAIMS:

1. A hair styling composition comprising by weight:
 - (a) up to 10% of at least one organic adhesive polymer;
 - 5 (b) up to 5% of at least one surfactant comprising an ethoxylated alcohol having an aliphatic chain length of up to 16 carbon atoms and a degree of ethoxylation of from 3 to 20 ethoxy groups per mole; and
 - (c) a solvent.
- 10 2. A hair styling composition according to Claim 1 which is in the form of a mousse additionally comprising a propellant.
3. A hair styling composition according to Claim 1 or 2, wherein the
15 surfactant (b) comprises from 0.1% to 1% by weight of the ethoxylated alcohol.
4. A hair styling composition according to any of Claims 1 to 3, wherein the surfactant comprises a C_{9-11} ethoxylated alcohol having a degree of ethoxylation of 8 ethoxy groups per mole.
- 20 5. A hair styling composition according to any of Claims 1 to 4, wherein the polymer is selected from anionic, cationic and amphoteric organic adhesive polymers.
- 25 6. A hair styling composition according to any of claims 1 to 5, which comprises from 1% to 3% by weight of the at least one polymer (a).

7. A hair styling composition according to claim 6, which comprises up to 5% by weight of the at least one polymer (a).

8. A hair styling composition according to Claim 7, which comprises from
5 2% to 2.5% by weight of the at least one polymer (a).

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/13500

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61K7/06 A61K7/11

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	EP 0 796 610 A (UNILEVER) 24 September 1997 see page 2, line 23-28; claims 1-3	1, 3-8
X	US 5 589 157 A (HATFIELD, J. C.) 31 December 1996 see claims 1, 2, 4-9, 16	1, 3-8
A	DE 14 67 825 A (CHESEBROUGH-PONDS) 2 January 1969 see claim 1	1, 3, 4

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"8" document member of the same patent family

Date of the actual completion of the international search

27 October 1998

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04/11/1998

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 98/13500

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 796610 A	24-09-1997	US 5714135 A JP 10007528 A	03-02-1998 13-01-1998
US 5589157 A	31-12-1996	US 5413775 A AU 4864093 A BR 9303935 A CA 2107195 A EP 0590604 A JP 6207073 A MX 9305982 A	09-05-1995 14-04-1994 10-05-1994 30-03-1994 06-04-1994 26-07-1994 31-01-1995
DE 1467825 A	02-01-1969	NONE	